開關型脈沖鐳射電源

Laser Power Supply

使用說明書

Operating Instructions

SP05 型脈沖鐳射電源

產品技術指標：

供電電壓：三相 380V ±10%

輸出功率：5KW

重複頻率：0～200HZ 連續調節

放電脈寬：0.1～20ms 連續調節

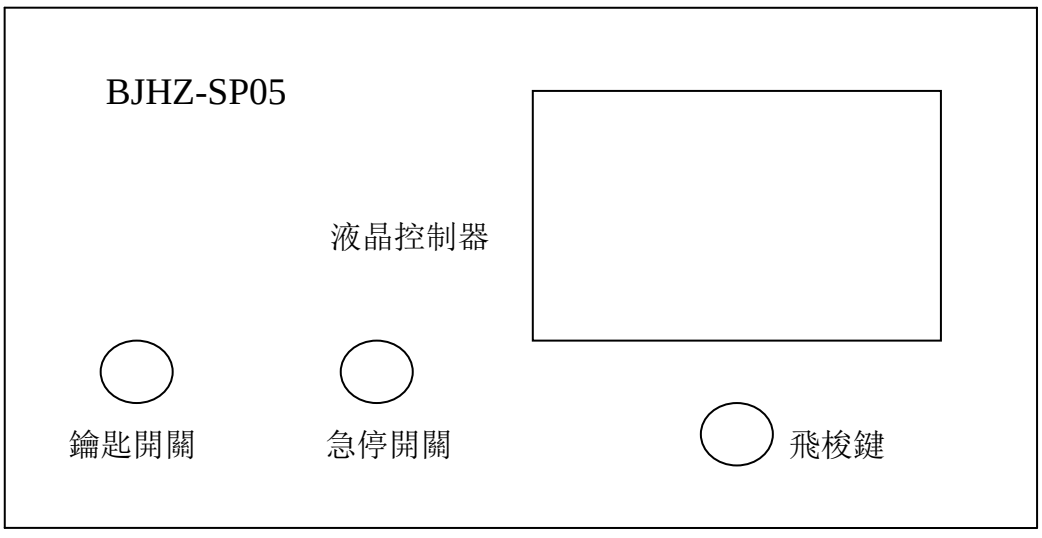
放電電壓調節範圍： 150V~400V 連續可調

適應負載： 氙燈 （單燈）

控制器頻率與脈寬的最大乘積：300 ms

前後面板示意圖：

前面板示意圖概述：



液晶控制器及界面操作說明：

本設備使用多功能飛梭鍵進行顯示介面的操作：

① 操控模式（MODE）

本設備設有操控模式（MODE），即各種操作是由電源本地操作（本地模式 LOCAL），還是由上位機通過 RS485 通訊遠程操控（遠程模式 REMOTE）。當操控模式為遠程模式時，用戶僅可以在本地改變操控模式，其他所有本地操作被禁止（因為均被遠程的上位機接管）。上位機的遠程通訊沒有改變操控模式的命令，操控模式的改變僅可以在本地進行。

有關通過 RS485 匯流排遠程操作的通訊協議請見另外的單獨說明。

以下按照開機後顯示畫面的順序來介紹本地模式（LOCAL）下的有關操作。

② 開機後畫面

本設備開機後會顯示基本型號和設備名稱及網址資訊。

1. 在本畫面下，三秒內如無任何操作，將切換到故障狀態檢測畫面；
2. 若在本畫面下按下飛梭鍵，將進入啟動設置畫面，在啟動設置畫面裏可設置吹氣延遲和液晶光柵延遲。
3. 在本畫面下，按照一定的方法旋轉飛梭鍵（相當於密碼）可使脈衝計數清零。具體旋轉方法是：

第 1 步 －－ 順時針旋轉 2 下

第 2 步 －－ 逆時針旋轉 8 下

第 3 步 －－ 順時針旋轉 6 下

操作成功後會響兩下，以示清零成功。

③ 啟動設置畫面（STARTUP SETUP）

在本畫面裏可設置吹氣延遲（HUFF DELAY）和液晶光柵延遲（GRATING DELAY）。基本操作方法是，旋轉飛梭鍵可使焦點迴圈滾動，當焦點在吹氣延遲或液晶光柵延遲上時，按下飛梭鍵顯示便變成上下各有一條橫線，表示此時可對其進行調整，旋轉飛梭鍵即可調整該參數。調整完後，按下飛梭鍵又恢復焦點顯示。其他的畫面也有與此相同的基本操作方法，不再贅述。

吹氣延遲的調整範圍是：0.0S ～ 9.9S （0.0S 表示無延遲）

液晶光柵延遲的調整範圍是：01ms ～ 10ms

除了本身的調整範圍外，液晶光柵延遲值的有效性還受限於如下限制關係－ [光柵＋脈寬≤週期－1ms] ，此式中光柵、脈寬、週期的單位都是 ms 。光柵、脈寬、周期之間的基本關係是必須[光柵＋脈寬<週期]，我們留了 1ms 的裕量，所以有了以上的式子。我們之前的 SP 系列電源，頻率最大是 20Hz，其週期是 50ms，所以[光柵＋脈寬<週期]的關係肯定能滿足，沒有此限制關係的判斷；但對於本臺設備，頻率最大是 200Hz，其周期是 5ms，所以在調節光柵、脈寬、頻率時有違反此限制關係的可能，因此本臺設備有了此限制關係的判斷－－[光柵＋脈寬≤週期－1ms]

旋轉飛梭鍵，使焦點置於 OK 上，按下飛梭鍵便可保存調整結果並退出；或者將焦點置於 CANCEL 上，按下飛梭鍵便放棄調整結果並退出。退出後，將切換到故障狀態檢測畫面。

④ 故障狀態檢測畫面

在本畫面裏，檢測水壓、溫度、電流是否正常，只有全部正常才能切換到後續的常態 操作畫面。若有故障，將會閃爍顯示並鳴叫報警（按下飛梭鍵可消除報警聲，此操作在遠程操控模式下同樣有效）。

⑤ 常態操作畫面

本畫面是設備正常工作時的常態畫面。本畫面下，可改變操控模式（MODE）、對預燃進行操作（SIMMER）、顯示放電脈衝計數（COUNT），另外最主要的一部分是顯示和調節各參數。本設備設有 10 個參數組，用戶可將當前各參數保存至某一組中（SAVE）或從某一組中調出來更新當前各參數（LOAD）。保存或調出前，先將參數組（GROUP）調至想保存或調出的那個組，然後再按下 SAVE 或 LOAD。

基本操作方法前已有述，對預燃（SIMMER）和首脈衝調整值（FPA）的操作略有不同。當顯示焦點處於預燃上時，按下飛梭鍵，顯示不會變為上下各有一條橫線，而是根據當前預燃的狀態來決定執行何種操作：若當前預燃為 ON，將會關閉預燃；若當前預燃為 OFF，將會打開預燃。當顯示焦點處於 FPA 上時，按下飛梭鍵，將會進入一個設置 FPA 的新畫面，在此新畫面中可調節設置各 FPA 值。

一個參數組中所包含的參數包括 5 種：頻率（F）、脈寬（PW）、電壓設置值（V）、光斑大小（SPOT）、首脈衝調整值（FPA） 。下麵對各參數調整範圍做一說明（正在放電時是禁止調節這 5 種參數的）：

1. 頻率（F）：0～200Hz（0Hz 表示單脈衝）。除了本身的調節範圍，頻率值的有效性還受

   限於如下 2 個限制關係－－

   一是[頻率×脈寬≤300]

   二是[光柵＋脈寬≤週期－1ms] ，說明見上文。

   當超出調節範圍或有效性受到違反時，將無法調節。

2. 脈衝寬度（PW）：0.1ms ～20ms 。除了本身的調節範圍，脈寬值的有效性還受限於如

   下 2 個限制關係－－

   一是[頻率×脈寬≤300]

   二是[光柵＋脈寬≤週期－1ms] ，說明見上文。

當超出調節範圍或有效性受到違反時，將無法調節。

3. 電壓設置值（V）：150V～400V

當超出調節範圍時，將無法調節。

4. 光斑大小（SPOT）：0.1mm ～3.0mm

當超出調節範圍時，將無法調節。

5. 首脈衝調整值（FPA）：見 FPA 設置畫面中的說明。

⑥ FPA 設置畫面（FPA SETUP）

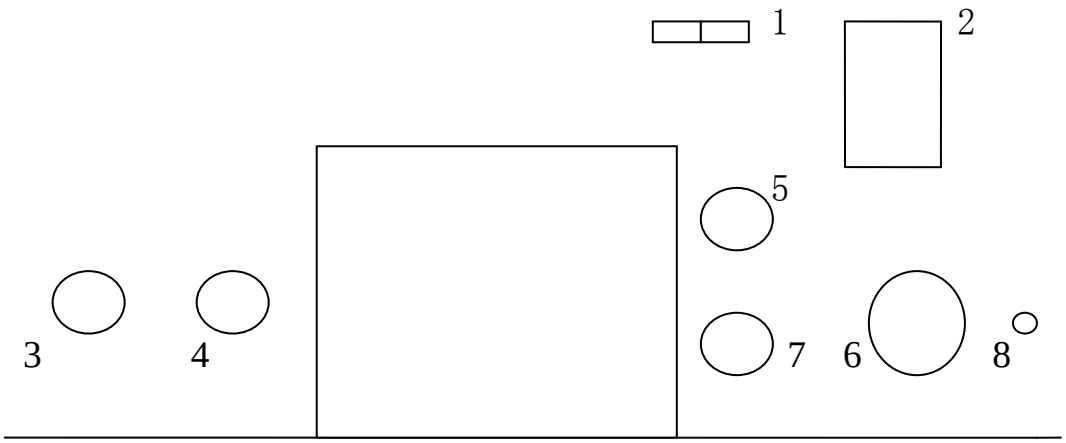
在此畫面中可調節設置各 FPA 值。本設備設有首脈衝調整功能，可對前 5 個脈衝進行能量調整，每個脈衝均可單獨調整。每個脈衝的 FPA 調整是通過對內部電路二個點的調整來進行的，我們稱之為 A 點和 B 點。A 點和 B 點的調整範圍是以內部默認值為基礎，正負分別可調到 50％，即－50％ ～ ＋50％ 。調整每個脈衝時，可能需要通過多次試驗以得到最優的 A 點調整值和 B 點調整值之組合。當不需 FPA 時，可將 A 值和 B 值調至 0。

調整完畢，將焦點置於 RETURN 上，按下飛梭鍵即可返回常態操作畫面。

注意：本設備的 FPA 功能為了通用性，A 值和 B 值均正負可調，並且可到 50％。在實際使用中，用戶根據自己的實際情況可能只需單邊調整（正向調整或負向調整）。在調整時，用戶應從 0 開始，謹慎地逐步增加或減小，要尤其避免從正值到負值或負值到正值的大起大落，否則可能會對設備造成損壞。

注：在腳踏開關閉合後，電源任何參數均不能調節。

後面板示意圖：



1. 通訊端口（RS485）： A B：連接應採用雙絞線

   腳踏：控制電源放電，應接常開點

2. 空氣開關：控制本機供電電源

3. 氙燈輸出正極：連接線應大於 6 平方毫米連接應牢實可靠

4. 氙燈輸出負極：連接線應大於 6 平方毫米連接應牢實可靠

5. 電源控制連接端口：

   ①. ②芯： 腳踏閉合後輸出交流 220V（1A）輸出（也可作為氣閥信號）

   ③. ④芯：水壓開關 用於用戶接水泵保護節點

   ⑥. ⑦芯：液晶光柵信號（+12V 方波信號輸出，6 腳為+ 7 腳為-）

   ⑧. ⑨芯：腳踏閉合信號（腳踏閉合後輸出一個高電平，8 腳為+ 9 腳為-）

6. 電源輸入進線：大 4 芯（1.2.3 腳 火線 4 腳 空）線徑總面積大於 4 平方毫米

7. 電機介面 9 芯定義（如圖示意）：

   1 針 VCC（+15V）

   2 針 電機的驅動方向（調節光斑大小，上升過程，輸出低電平；下降過程，輸出高電平）

   3 針 空

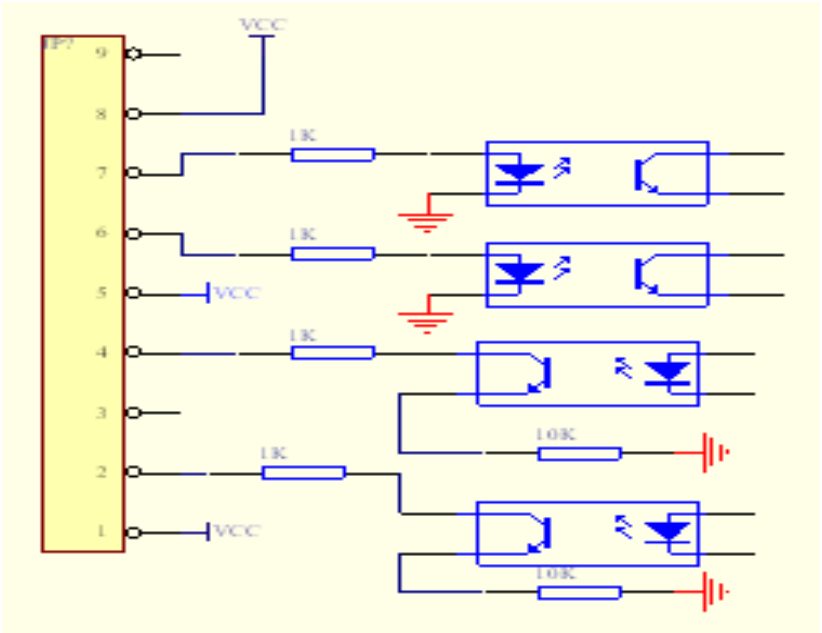
4 針 電機的驅動（只要改變光斑大小就會輸出 300 個脈寬為 40us 的正方波信號）。

5 針 VCC（+15V）

6 針 暫無輸出

7、8 針 下限位開關（此開關作用於電源開機初始化後，程式會連續發出電機的驅動信號去尋找光斑大小的最小值，到達最小值後此開關閉合，電源會檢測並回到上次設置光斑大小值。如用戶不用該點必須短接，如不短接將無法通過初始化過程）

9 針 空



8. 保護接地

性能特點：

本電源採用了新型的功率變換電路和功率開關器件，實現了軟開關的工作模式，具有損耗低、穩定性好、可靠性高的特點。面板所設的開關按鈕可分部操作。本電源設有輸入的軟起動，逆變橋具有峰值過流保護，輸出電壓具有過充電保護功能。操作安全可靠。電源工

藝好，元件放置適當、整齊、佈線合理、清晰，所有線都採用分色法標注。

電源使用注意事項：

1.氙燈動態阻抗：大於或等於 1.3 歐姆意思是氙燈的電流最大為 330A

2.電源進線：火線 4 方毫米

3.氙燈輸出線應採用高絕緣外皮，線徑不小於 6 平方毫米連接線

4.各功能控制連接應正確，連接應牢實可靠

5.嚴格按照說明書操作

維修指南：

1. 開電鑰匙開關，水泵不工作。

A）檢查是否有電源輸入

B）檢查輸入空氣閘是否閉合

C）檢查電鑰匙開關是否損壞

2. 通電後控制器上無指示

A）檢查弱電板、控制器的插接件接觸是否良好

B）檢查弱電板上的保險管是否損壞

C） 檢查控制器電源內元器件有無虛焊

D） 檢查弱電變壓器是否燒壞

3. 按下預燃後，電源不啟動

A）檢查水泵控制線是否與機器正確連接

B）檢查預燃板插接件接觸是否良好，負載是否接好

C）檢查預燃板是否正常

4. 工作後預燃淬滅

A）檢查預燃電流是否正常

B）檢查氙燈是否老化

C）檢查氙燈極性是否接錯

Pulsed Laser Power Supply

Operating Instructions

Pulsed Laser Power Supply APL-SP05

Product Specification：

Supply Voltage: Three Phase, 380V±10%

Output Power: 5kW

Repetition Rate: 0~200HZ, Continuously Adjustable

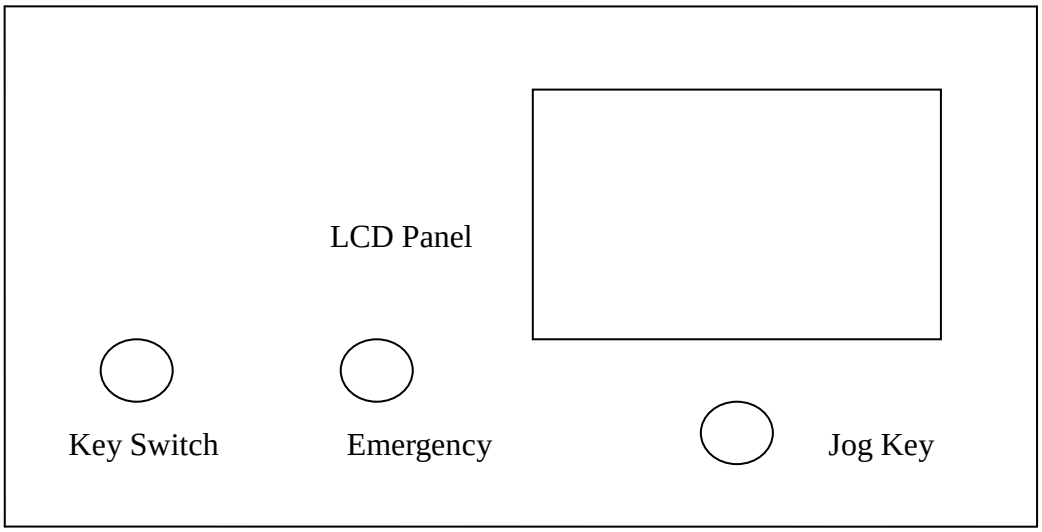
Discharge Pulse Width: 0.1~20ms, Continuously Adjustable

Discharge Voltage Adjustment Range: 150V~400V, Continuously Adjustable

Adapted Loading: Xenon Lamp (Single Lamp)

The Max Product of Controller Frequency and Pulse Width: 300ms

Schematic of Front Panel：



LCD controller and interface instructions：

This device use jog key to control the display interface.

②MODE

Users could choose the mode to control this device, there’re “LOCAL” and “REMOTE”, the “REMOTE” mode has to be controlled by the computer which is translated the signals via RS485. When users choose “REMOTE”, all “LOCAL” operation is disable. “REMOTE” mode couldn’t change the operating mode of this device, users could change the mode in “LOCAL” mode.

With regards to the Communication Code of RS485, please see the single statement.

Following is the introduction of “LOCAL” mode operation in accordance with the display shown by turn after starting this device.

⑥ STARTUP

Users could see the type and the name of this device and the website of the manufacture.

1. If users don't choose any function to operate in this display in three seconds, it will switch to fault detection.

2. If users push the jog key in this display, it will enter the setting function, users could set "Huff Delay" and "Grating Delay" in this function.

3. In this Display, users could clear the pulse count by turning the jog key with certain method (equals to the password).

The method is below.

First Step—Turn the jog key two steps clockwise.

Second Step—Turn the jog key eight steps anticlockwise.

Third Step—Turn the jog key six steps clockwise.

If the operation is successful, it will ring twice to show clear successfully.

⑦ STARTUP SETUP

Users could set "Huff Delay" and "Grating Delay" in this display. The operating method is turning the jog key, it could control the cursor on the screen. When the cursor moves to "Huff Delay" or "Grating Delay", press the jog key then there is a top line and bottom line on the parameter users choose, that means users could adjust the parameter by turning the jog key. Press the jog key after adjusting then the cursor will return. The adjusting method is the same in other function.

The adjusting range of "Huff Delay" is 0.0s~9.9s. (0.0s means no delay.)

The adjusting range of "Grating Delay" is 0.1s~1.0s.

The "Grating Delay" has the limit by the below relationship to decide it's effective or not, "Grating + Pulse

Width ≤ Cycle -1ms". The unit of "Grating, Pulse Width and Cycle" in this relationship is ms. There's 1ms tolerance so the relationship among "Grating, Pulse Width and Cycle" is "Grating + Pulse Width ＜ Cycle". For this device, the max frequency is 200Hz, the cycle is 5ms.

Turning the jog key to move the cursor on "OK" then press the jog key to save the adjusting result and exit setting. If users wouldn't like the adjusting result, move the cursor on "CANCEL" then press the jog key to quit. Then the screen will show fault detection.

⑧ Fault Detection

The device will detect the water pressure, temperature and current is normal or not, the screen will be turned to the operating display until the above parameters are normal. If the fault occurs, the LCD will flash and beep (press the jog key could stop the LCD's flash and beep, this operation is also useful in "REMOTE" mode).

⑨ Normal Operation

In the screen of Normal Operation, users can change the mode(MODE), operate the pre-heat(SIMMER) and see the pulse counting(COUNT). Also in this screen, users could see and adjust the parameters. There're ten sets of parameters for users to save(SAVE) and load any set of the saved parameters to change a new set. Before "SAVE" and "LOAD", choose which group users want to save in or load, then press on "SAVE" or "LOAD".

It's different to set "SIMMER" and "FPA" with the operation stated above. When the cursor is on "SIMMER", push the job key, it depends on the statement of simmer to decide the operation. When the statement of simmer is "ON", the simmer will be closed; when the statement of simmer is "OFF", the simmer will be open. Move the cursor on "FPA" then push the jog key, the screen will show the display of setting FPA, users can adjust each value of FPA.

There're five parameters in a parameter group, they're frequency(F), pulse width(PW), voltage(V),

spot(SPOT) and FPA(FPA). Following is the statement of the adjusting range of each parameter. (It's forbidden to adjust these five parameters during laser discharging.

1. Frequency(F): 0~200Hz(0Hz means single pulse). Instead of the adjusting range, the effectiveness of frequency is limited by the following two relations. 1. Frequency×Pulse Width≤300. 2. Grating + Pulse Width ≤ Cycle -1ms. The statement has been explained in the former paragraph. When the adjusting is out of the adjusting range or the limited relations, the adjusting won't work.

2. Pulse Width(PW): 0.1ms~20ms. Instead of the adjusting range, the effectiveness of frequency is limited by the following two relations. 1. Frequency×Width≤300. 2. Grating + Pulse Width ≤Cycle-1ms. The statement has been explained in the former paragraph. When the adjusting is out of the adjusting range or the limited relations, the adjusting won't work.

3. Voltage(V): 150V~400V

When the adjusting is out of the adjusting range, the adjusting won't work.

4. SPOT: 0.1mm~3.0mm

When the adjusting is out of the adjusting range, the adjusting won't work.

5. FPA: Please see the statement below for FPA SETUP.

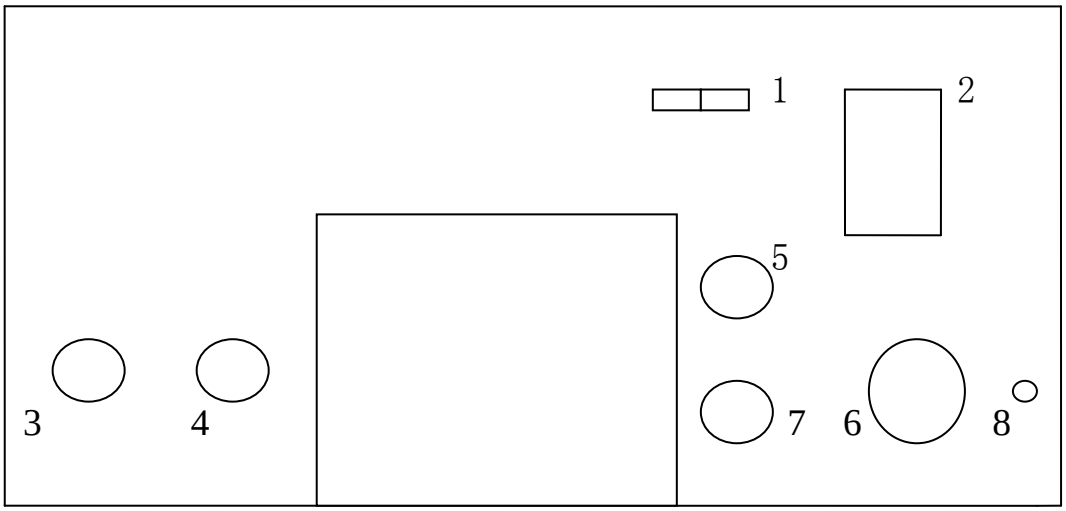
⑩ **FPA SETUP**

In the screen of FPA SETUP, users can adjust the value of FPA. The power supply has the function of adjusting the first to the fifth pulse energy, each pulse energy could be adjusted singly. The FPA adjusting of each pulse has to be set the two points of the inner circuit, we call them point A and point B. The adjusting range of point A and point B is base on the internal default value, the range is -50%~+50%. Users have to test for several times to get the best point A and point B when adjust FPA. When users don't need FPA, point A and point B could be adjusted to be 0.

After finishing adjusting, move the cursor on “RETURN” then press the jog key to return “NORMAL OPERATION”.

Note: For the versatility of adjusting of FPA of this power supply, the point A and point B could be adjusted positive and negative. Users only need to adjust positive or negative and start from 0 and adjust gradually, must avoid adjusting from positive to negative or from negative to positive with too big difference of value, it will cause damage to this power supply. After the foot switch switching on, all parameter couldn’t be adjusted.

Schematic of Rear Panel：



9. Communication Port（RS485）： A B：The connection should use twist pair line. Foot Switch: Control the pulse of power supply and has to be switched on.
10. Solenoid Valve: Control the power supply for this equipment.
11. Anode of Xe lamp output: The connecting wire should be bigger than 6mm^2 and connected safely and firmly.
12. Cathode of Xe lamp output: The connecting wire should be bigger than 6mm^2 and connected safely and firmly.
13. Connecting ports of each control of power supply:

Pin ①. ②: The foot switch is connected then the output is AC220V(1A). (It also could be the valve signal.)

Pin ③. ④: Water Pressure Switch, for water pumping protection.

Pin ⑤: NC—No Connection.

Pin ⑥. ⑦: LCD Grating Signal(+12V square wave signal output, pin ⑥ is +, pin ⑦ is -.)

Pin ⑧. ⑨: Foot Switch Connecting Signal (When the foot switch is connected, the wave line will be high, users could measure it by oscilloscope, pin 8 is +, pin 9 is -.)

14. Power Input Line: With 4 pins inside (pin 1, 2 and 3—live wires, pin 4—none.) The total diameter is bigger than 4mm^2.

15. The definition of 9 pins of electric interface (As the figure shown.):

pin 1: VCC (+15V)

pin 2: The driver direction (Adjust the spot size, rising process, output low, dropping process, output high.)

pin 3: none

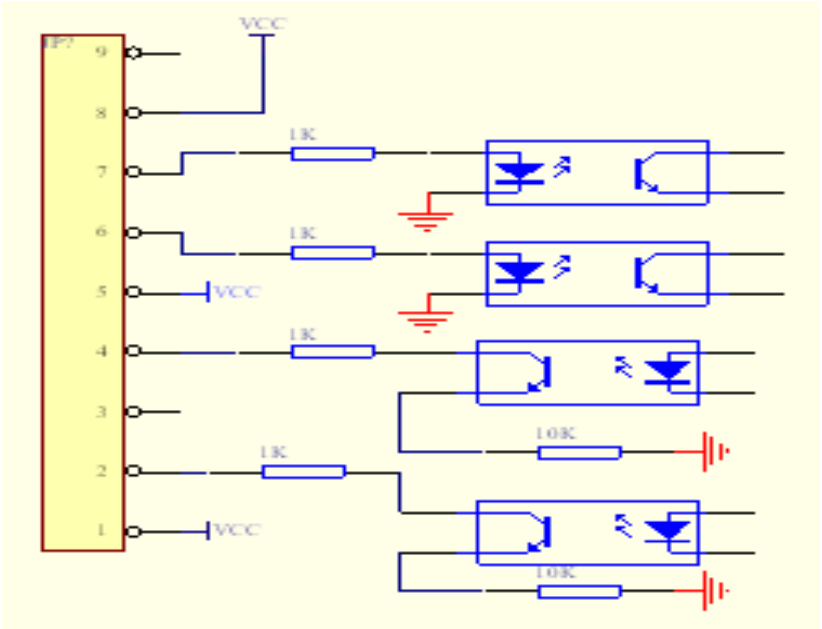
pin 4: Electric driver(As long as users change the spot size, there will be 300 square wave signal with the width of 40us.)

pin 5: VCC（+15V）

pin 6: None

pin 7, 8: Original Sign (The pins are used for initializing after turning on this power supply, the program will send continuous signals to search the original sign then turn on the power supply.) Regarding with these two pins, they have been shorten.

pin 9: None



16. Protective Earthing.

Characters:

This power supply use the new power transfer network and power switch component to let user could control this power supply by computer. The bottoms on the front panel could be used singly. This power supply has input software, peak current protection for inverter and overcharge protection for output power. It's very safety to operate and with good quality. All components and layout are set appropriately and all lines are marked using color separation method.

Notes of Power Supply Operation:

1. Xe lamp dynamic impedance: bigger than or equals to 1.3 ohms, that means the biggest current is 330A.
2. Wires of Power Supply: Live Wires with $4mm^2$.
3. Xe Lamp output wires should be with high insulation jacket and the diameter is bigger than or equals to $6mm^2$.
4. Each connection to controller of each function should be connected correctly and firmly.
5. Users have to operate this power supply according to the manual.

Repair Guide:

3. Switch the key to turn on but the water pump doesn't work.
   A) Check if there is input power.
   B) Check if the solenoid valve is connected.
   C) Check if the key is broken.

4. There’s no indication on the front panel after turning on the power supply.

A) Check the pins of the digital board and control are connected well or not.

B) Check if the fuse of the digital board is broken.

C) Check if the components inside the power supply be welded well.

D) Check if the digital transformer is broken.

3. Choose “SIMMER” but the power supply doesn’t work.

D) Check if the water pumping control line is connected with the power supply.

E) Check if the simmer digital board and the load are connected well.

F) Check if the simmer board is normal.

4. The “SIMMER” is off after working.

D) Check if the simmer current is normal.

E) Check if the Xe lamp is ageing.

F) Check if the Xe lamp is installed wrong.